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READERS of THE BRYOLOGIST will be interested to know that in this, its first year of independent existence, it has just paid for itself. This may seem a poor showing to those not acquainted with such matters, but we can assure our readers that it is a better financial showing than many more pretentious scientific journals can make. Encouraged by the cordial reception given the BRYOLOGIST during the past year, the EDITORS have decided to add four pages to each issue and illustrate more freely, nearly doubling the cost of the journal.

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IN order to fill the additional space with material, we earnestly solicit from our readers more short notes on interesting finds. The notes on *Buxbaumia* in this number will illustrate what is meant.

VEGETATIVE REPRODUCTION OF MOSSES.

BY G. N. BEST.

The asexual or vegetative reproduction of mosses, by which we mean the multiplication of these plants by other means than by sexually formed spores, is accomplished in two general ways, either by parts of the plants normally considered, or by adventitious formations which appear on the normal plant for this purpose.

More than fifty years ago Schimper* made the broad assertion that "every leaf and every portion of a leaf detached from the mother plant and placed under favorable conditions can produce proembryonic filaments," and more recently Limpricht† has stated that "all parts of a moss plant have the capacity to produce secondary protonema." It remained, however, for Heald‡ to demonstrate experimentally that if a moss leaf was detached from its stem and placed under favorable conditions for growth, it would produce rhizoids from its its lower surface and protonema from its upper, and that in time buds would appear on the latter, and that these would ultimately grow into the vegetative plant. But it is to Correns‖ more than to anyone else that we are indebted for a comprehensive treatise on this subject.

It is of interest to note that the outer cells of the stems and branches of a moss plant, as well as the leaf cells, are analogous in function to sexually formed spores, in that they have the capacity to produce rhizoids and protonema, and thus reproduce the parent plant. While it is exceptional for vegetative buds to appear on the rhizoids, they sometimes so occur. It is not uncommon, however, for rhizoids to produce secondary protonemata and for buds to appear on these as on primary protonemata.

*Recherches Anat. et Morph. sur les Mousses, 19, 1848.

†Die Laubmoose, **1**:61, 1890.

‡Bot. Gaz., **26**:169, 1898.

‖Vermehrung der Laubmoose, 1899.

The stems of most mosses are made up of a succession of similar parts, the annual growths, and are separable or transversely breakable at certain points, more especially at the points where one season's growth ends and the next begins. When a part is detached and is carried to a favorable spot, it commences its growth by producing rhizoids, which serve the double purpose of fastening it to a substratum and of assisting in its nourishment. The part may now continue its growth and develop into a plant, or it may produce protonemata with vegetative buds directly, or by the intervention of rhizoids. Branches, when detached from their stems, usually reproduce the plant in the same manner as stems. They are, however, in some species, as *Campylopus flexuosus*, provided with special means for vegetative reproduction. At a certain point, usually near its distal end, the branch is so weakened by a cleavage in its walls (Trennschicht), that the terminal portion is readily shed. When detached, these end branches (Endknospen) grow into plants in the manner already detailed. In structure and development they are closely related to bulbils. When a leaf of a moss plant is detached from its stem (which often happens as the result of mechanical action or of a process of fatty degeneration of its insertion cells, as in *Dicranum scoparium*) and finds a favorable lodgment, it reproduces the parent plant as stated when reference was made to Heald's experiments, more rarely by vegetative buds directly from its surface. In some species, as *Dicranum viride* and *Anomodon tristis*, the leaves are transversely breakable by a line of weakened cell cohesion, the detached or broken parts reproducing the plant as is done by the whole leaf.

The adventitious formations which serve to propagate asexually the moss plants are of two kinds, bulbils, sometimes called gammae, and brood bodies, sometimes called propagula. In their simplest form, bulbils are little buds without apparent central axes, and usually appear on the stem, as in *Webera annotina*, but may be located on any part of the moss plant. When shed, sometimes even before, they produce rhizoids and grow directly into the vegetative plant. In their higher development, with rudimentary stems and leaves, they appear in bud-like aggregations on the end of stems, as in *Leskea nervosa*, sometimes on branches as well. In their highest development, their character as shoots becomes apparent, with stems and leaves, as in *Dicranum flagellare*, growing into plants, however, in precisely the same manner as is done by the simplest forms.

Brood bodies are polymorphous and variously located. In their simplest form they are deciduous rhizo-protonemata which appear in clusters on stems, often on midveins, as in *Plagiothecium Roeseanum*. They are, however, usually more complex in structure, and are sometimes borne on specialized stems and branches, the pseudopodia, as in *Aulacomnium palustre;* or in a cup-shaped involucre, as in *Georgia pellucida;* or on rhizoids (Brutknollen), as in some of the Barbulae; or on the excurrent costa, as in *Ulota phyllantha;* or on the paraphyses, as in *Pottia riparia;* or on the upper surface of leaves, as in *Tortula papillosa;* or on both surfaces, as in *Orthotrichum Lyellii;* or in fasciculate clusters on the midrib at the base of the leaves, as in *Grimmia torquata*. In whatever form or position they appear, their function is the same, the reproduction of the parent plant, which they accomplish by producing protonemata.

What are these brood bodies, and what structures do they represent? Evidently they are either metamorphesed buds or leaves. It may be conjectured that there was a time in the history of these plants when they were destitute of sporophytes, and that vegetative reproduction was the only means of their multiplication. Even at this day, were it not for this factor, our moss flora would dwindle away and become but a remnant of what it now is. By the action of winds, rains and snows, these brood bodies, as also stem segments and leaves, are not only loosened from their attachments, but are carried away, sometimes to considerable distances, and thus become effective not only in the propagation but in the dissemination as well, of the plants from which they were derived.

HYLOCOMIUMS OF THE NORTHEASTERN UNITED STATES.

By Annie Morrill Smith.

Key to the species.

Leaves secund, sharply serrate at apex, costa long and single; alar cells quadrate, 1. rugosum

Leaves not secund (equally spreading).

Paraphyllia none.

Leaves sulcate, bicostate: leaf cells enlarged at base, 2. triquetrum

Leaves slightly sulcate, faintly bicostate or ecostate, a triangular patch of orange cells at angles, 3. parietinum

Leaves not sulcate, faintly bicostate, alar cells somewhat enlarged and more hyaline, not inflated, suddenly recurved-squarrose at tip, 4. squarrosum

Paraphyllia present.

Leaves deeply sulcate, with long distinct double nerve, serrate in upper half, 5. umbratum

Leaves obscurely bicostate; paraphyllia pinnate: branches 2–3 pinnate, 6. proliferum

Leaves distinctly double nerved: parayhyllia minute: branches irregularly pinnate, 7. brevirostre

Leaves one-nerved to middle, coarsely serrate, 8. Pyrenaicum

In the present study of Hylocomiums, eight species found in northeastern America have been included. Lesquereux & James' Manual cannot be followed in this genus. *H. rugosum* is there placed in the subgenus Rhytidium, *H. Schreberi* in the Calliergon group. I prefer to follow Limpricht and include the latter among the Hylocomiums, dropping also Lesquereux & James' subgenus Pleurozium, and counting all in one genus. *H. robustum* and *H. loreum* are of western range only, and are therefore omitted.

It is difficult to describe in words the differences which separate the Hylocomiums from the Hypnums, but when once the general appearance of the plants is learned, one can readily see a strong family resemblance. They are of free and robust growth, loving both damp and shade as well as the open situations. Most of our species of Hylocomiums fruit sparingly or infrequently, the capsules maturing in late summer or autumn. *H. rugosum* never fruits with us, but fruits abundantly in the Klondike.